

# Year 12 PURE Mathematics Key Stage 5 Maths Curriculum

Autumn 1	
<b>Pure Chapter 1: Algebraic Expressions</b>	<b>Pure Chapter 2: Quadratics</b>
<b>Assessment:</b> Ch 1 & 2 Algebraic expressions and quadratics	<b>Assessment:</b> Ch 1 & 2 Algebraic expressions and quadratics
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>Collecting like terms and factorising</li> <li>Surds</li> <li>Rules of indices</li> <li>Understanding factors and multiples, HCF and LCM</li> <li>Working out prime factor decomposition</li> <li>Estimate the square or cube root of an integer</li> </ul>	<b>Builds Upon:</b> <ul style="list-style-type: none"> <li>Writing formulae from sentences</li> <li>Substitution (positive and negative numbers)</li> <li>Changing the Subject of Formulae</li> <li>Mapping diagrams and composite functions</li> <li>Distinguishing between expressions, equations, inequalities, formulae and identities</li> <li>Expanding and factorising quadratics (no coeff of x)</li> <li>Difference of two squares</li> <li>Factorising quadratics with a coeff of x</li> <li>Simplifying algebraic fractions involving quadratics</li> </ul>
<b>Introduces:</b> <ul style="list-style-type: none"> <li>Expand a single term over brackets and collect like terms</li> <li>Expand the product of two or three expressions</li> <li>Factorise linear, quadratic and simple cubic expressions</li> <li>Know and use the laws of indices</li> <li>Simplify and use the rules of surd</li> <li>Rationalise denominators</li> </ul>	<b>Introduces:</b> <ul style="list-style-type: none"> <li>Solve quadratic equations using factorisation and the quadratic formula</li> <li>Solve quadratic equations by completing the square</li> <li>Read and use <math>f(x)</math> notation when working with functions</li> <li>Sketch the graphs and find the turning point of a quadratic function</li> <li>Find the interpret the discriminant of a quadratic expression</li> <li>Use and apply models that involve quadratic functions</li> </ul>
<b>Pure Chapter 5: Straight line graphs</b>	<b>Pure Chapter 3: Equations and inequalities</b>
<b>Assessment:</b> Ch 5 & 6 Straight line graphs and circles	<b>Assessment:</b> Ch 3 & 4 Equations and inequalities and Graphs and transformations
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>Gradient and y-intercept</li> </ul>	<b>Builds Upon:</b> <ul style="list-style-type: none"> <li>Understand inequalities</li> </ul>

<ul style="list-style-type: none"> <li>• Parallel and perpendicular lines</li> <li>• Equation of a straight line</li> </ul>	<ul style="list-style-type: none"> <li>• Solve inequalities</li> <li>• Solving Inequalities and representing solutions on a number line</li> <li>• Forming and Solving Equations</li> <li>• Solving quadratics without coeff of <math>x^2</math> by factorising</li> <li>• Solving quadratic equations by reading off graphs (provide graphs if unable to plot)</li> <li>• Simultaneous Equations (elimination)</li> <li>• Simultaneous Equations (substitution)</li> <li>• Forming and Solving Simultaneous Equations</li> </ul>
<p><b>Introduces:</b></p> <ul style="list-style-type: none"> <li>• Calculate the gradient of a line joining a pair of points</li> <li>• Understand the link between the equation of a line, and its gradient and intercept</li> <li>• Find the equation of a line given (i) the gradient and one point on the line or (ii) two points on the line</li> <li>• Find the point of intersection for a pair of straight lines</li> <li>• Know and use the rules for parallel and perpendicular lines</li> <li>• Solve length and area problems on coordinate grids</li> <li>• Use straight line graphs to construct mathematical models</li> </ul>	<p><b>Introduces:</b></p> <ul style="list-style-type: none"> <li>• Solve linear simultaneous equations using elimination or substitution</li> <li>• Solve simultaneous equations one linear and one quadratic</li> <li>• Interpret algebraic solutions of equations graphically</li> <li>• solve linear inequalities</li> <li>• interpret inequalities graphically</li> <li>• represent linear and quadratic inequalities graphically</li> </ul>

## Autumn 2

<b>Pure Chapter 4: Graphs and transformations</b>	<b>Pure Chapter 6 Circles</b>
<b>Assessment:</b> Ch 3 & 4 Equations and inequalities and Graphs and transformations	<b>Assessment:</b> Ch 5 & 6 Straight line graphs and circles
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Functional notation and shapes of standard graphs (e.g. parabola, cubic, reciprocal)</li> <li>• To recognise and draw graphs of cubic and reciprocal functions.</li> <li>• To recognise and draw graphs of exponential functions and trigonometric functions</li> <li>• To recognise and sketch translation and reflections of graphs</li> <li>• Real-life graphs</li> <li>• Gradients and areas under graphs</li> <li>• Equation of a circle and find the tangent to a circle at a point</li> </ul>	<b>Builds Upon:</b> <ul style="list-style-type: none"> <li>• Gradient and y-intercept</li> <li>• Parallel and perpendicular lines</li> <li>• Equation of a straight line</li> <li>• Calculate the gradient of a line joining a pair of points</li> <li>• Understand the link between the equation of a line, and its gradient and intercept</li> <li>• Find the equation of a line given (i) the gradient and one point on the line or (ii) two points on the line</li> <li>• Find the point of intersection for a pair of straight lines</li> <li>• Know and use the rules for parallel and perpendicular lines</li> <li>• Solve length and area problems on coordinate grids</li> <li>• Use straight line graphs to construct mathematical models</li> </ul>
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Sketch cubic graphs</li> <li>• Sketch quartic graphs</li> <li>• Sketch reciprocal graphs of the form <math>y=a/x</math> and <math>y = a/x^2</math></li> <li>• Use intersection points of graphs to solve equations</li> <li>• Translate graphs</li> <li>• Stretch graphs</li> <li>• Transform graphs of unfamiliar functions</li> </ul>	<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Find the mid point of a line segment</li> <li>• Find the equation of the perpendicular bisector to a line segment</li> <li>• Know how to find the equation of a circle</li> <li>•</li> <li>• Solve geometric problems involving straight lines and circles</li> <li>• Use circle properties to solve problems on coordinate grids</li> <li>• Find the angle in a semi circle and solve other problems involving circle and triangles</li> </ul>
<b>Pure Chapter 12: Differentiation</b>	
<b>Assessment: Chapter assessment 12 Differentiation</b>	
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Solving quadratics</li> </ul>	

- Coordinate geometry
- Proof
- Function notation
- Indices
- Fractions
- Area of 2D shapes
- Volume and surface area of 3D shapes
- Rearranging equations

**Introduces:**

- Find the derivative,  $f'(x)$  or  $dy/dx$  of a simple function
- Find the derivative,  $f'(x)$  or  $dy/dx$  of a simple function
- Find the derivative,  $f'(x)$  or  $dy/dx$  of a simple function
- Find the derivative,  $f'(x)$  or  $dy/dx$  of a simple function
- Find the derivative,  $f'(x)$  or  $dy/dx$  of a simple function
- Use the derivative to solve problems involving gradients, tangents and normals
- Identify increasing and decreasing functions
- Find the second order derivative of a simple function
- Find stationary points of functions and determine their nature
- 
- Sketch the gradient function of a given function
- Model real-life situations with differentiation

## Spring 1

<b>Pure Chapter 13: Integration</b>	<b>Chapter 7: Algebraic methods</b>
<b>Assessment:</b> Chapter assessment 13 Integration	<b>Assessment:</b> Chapter assessment 7 & 8 Algebraic methods and Binomial expansion
<b>Builds Upon:</b> <ul style="list-style-type: none"> <li>• Algebraic manipulation</li> <li>• Differentiation</li> </ul>	<b>Builds Upon:</b> <ul style="list-style-type: none"> <li>• Factorising quadratics</li> <li>• Algebraic notation</li> </ul>
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Find <math>y</math> given <math>dy/dx</math></li> <li>• Integrate polynomials</li> <li>• Integrate polynomials</li> <li>• Find <math>f(x)</math>, given <math>f'(x)</math> and a point on the curve</li> <li>• Evaluate a definite integral</li> <li>• Find the area bounded by a curve and the <math>x</math> axis</li> <li>• Find the area bounded by a curve and straight lines.</li> </ul>	<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Cancel factors in algebraic fractions</li> <li>• Divide a polynomial by a linear expression</li> <li>• Use the factor theorem to factorise a cubic expression</li> <li>• Construct mathematical proofs using algebra</li> <li>• Use proof by exhaustion and disproof by counter-example</li> </ul>
<b>Pure Chapter 8: Binomial expansion</b>	
<b>Assessment:</b> Chapter assessment 7 & 8 Algebraic methods and Binomial expansion	
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Expanding brackets</li> <li>• Substitution</li> <li>• Proof</li> </ul>	
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Use Pascals' triangle to identify binomial coefficients and use them to expand simple binomial expressions</li> <li>• Use combinations and factorial notation</li> <li>• Use the binomial expansion to expand brackets</li> <li>• Find individual coefficients in a binomial expansion</li> <li>• Make approximations using the binomial expansion</li> </ul>	

## Spring 2

<b>Pure Chapter 9: Trigonometric ratios</b>	<b>Pure Chapter 10: Trigonometric identities and equations</b>
<b>Assessment:</b> Chapter assessment 9 & 10 Trigonometric ratios, identities and equations	<b>Assessment:</b> Chapter assessment 9 & 10 Trigonometric ratios, identities and equations
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Quadratics</li> <li>• Graph transformations</li> <li>• Pythagoras' Theorem</li> <li>• Trigonometry in right-angled triangles</li> </ul>	<b>Builds Upon:</b> <ul style="list-style-type: none"> <li>• The sine rule</li> <li>• The cosine rule</li> <li>• The area of a triangle</li> <li>• Bearing</li> </ul>
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Use the cosine rule to find a missing side or angle</li> <li>• Use the sine rule to find a missing side or angle</li> <li>• Use both the cosine and sine rule</li> <li>• Find the area of a triangle using an appropriate formula</li> <li>• Solve problems involving triangles</li> <li>• Sketch graphs of the sine, cosine and tangent functions</li> <li>• Sketch simple transformations of these graphs</li> </ul>	<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Calculate the sine, cosine and tangent of any angle</li> <li>• Know the exact trigonometric ratios for 30, 45 and 60 degrees</li> <li>• Know and use the relationships of the trig ratios</li> <li>• Solve trigonometric equations of the forms <math>\sin x = k</math>, <math>\cos x = k</math> and <math>\tan x = k</math></li> <li>• Solve more complicated trigonometric equations of the forms <math>\sin nx = k</math>, <math>\sin(x+a) = k</math> and equivalent equations involving <math>\cos</math> and <math>\tan</math></li> <li>• Solve trigonometric equations that produce quadratics</li> </ul>
<b>Pure Chapter 14: Exponentials and logarithms</b>	
<b>Assessment:</b> Chapter assessment 14 Exponentials and logarithms	
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Indices</li> <li>• Compound interest</li> </ul>	
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Sketch graphs of the form <math>y = a^x</math>, <math>y = e^x</math> and transformations of these graphs</li> <li>• Differentiate <math>e^x</math> and understand why this result is important</li> <li>• Use and interpret models that use exponential functions</li> <li>• Recognise the relationship between exponents and logarithms</li> <li>• recall and apply laws of logarithms</li> <li>• Solve equations of the form <math>a^x = b</math></li> </ul>	

- Describe and use the natural logarithm function
- use logarithms to estimate the values of constants in non-linear models

Summer 1	
<b>Pure Chapter 11: Vectors</b>	<b>Pure Chapter 1 (Year 2): Algebraic Methods</b>
<b>Assessment:</b> Chapter assessment 11 Vectors	<b>Assessment:</b> Chapter assessment 1 Algebraic Methods
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Surds</li> <li>• Trigonometry</li> <li>• Vectors</li> </ul>	<b>Builds Upon:</b> <b>(GCSE (9 1) in Mathematics at Higher Tier)</b> <ul style="list-style-type: none"> <li>• Pythagoras Theorem</li> <li>• Trigonometry</li> <li>• Algebraic manipulation including completing the square</li> <li>• Surds, prime and irrational numbers</li> </ul> <b>(AS Mathematics - Pure Mathematics content)</b> <ul style="list-style-type: none"> <li>• 1.1 Proof</li> </ul>
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Use vectors in two dimensions</li> <li>• use column vectors and carry out arithmetic operations</li> <li>• Calculate the magnitude and direction of a vector</li> <li>• Understand and use position vectors</li> <li>• Use vectors to solve geometric problems</li> <li>• Understand vector magnitude and use vectors in speed distance calculations</li> <li>• Use vectors to solve problems in context</li> </ul>	<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Use proof by contradiction to prove true statements</li> <li>• Multiply and divide two or more algebraic fractions</li> <li>• Add or subtract two or more algebraic fractions</li> <li>• Convert an expression with linear factors in the denominator into partial fractions</li> <li>• Convert an expression with repeated linear factors in the denominator into partial fractions</li> <li>• Divide algebraic expressions</li> <li>• Convert an improper fraction into partial fraction form</li> </ul>
<b>Pure Chapter 2 (Year 2): Functions &amp; Graphs</b>	
<b>Assessment:</b> Chapter assessment 2 Functions & Graphs	
<b>Builds Upon:</b> <b>GCSE (9 1) in Mathematics at Higher Tier</b> <ul style="list-style-type: none"> <li>• Algebraic fractions</li> </ul> <b>AS Mathematics - Pure Mathematics content</b> <ul style="list-style-type: none"> <li>• 2.6 Algebraic division, factor theorem</li> </ul>	
<b>Introduces:</b>	



- Understand and use the modulus function
- Understand mappings and functions, and use domain and range
- 
- Combine two or more functions to make a composite functions
- Know how to find the inverse of a function graphically and algebraically
- Sketch the graphs of the modulus functions  $y=|f(x)|$  and  $y=f(|x|)$
- Apply a combination of two (or more) transformations to the same curve
- Transform the modulus function
- Catch up or consolidation lesson

Summer 2	
<b>Pure Chapter 5: Radian</b>	<b>Pure Chapter 3: Sequences and series</b>
<b>Assessment:</b> Chapter 5 Radian	<b>Assessment:</b> Chapter 3: Sequences and series
<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Length of arc and area of sector</li> </ul>	<b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b> <ul style="list-style-type: none"> <li>• Generate terms of a sequence from either a term-to-term or a position-to-term rule</li> <li>• Use simple arithmetic and geometric progression and geometric sequence</li> </ul> Finding expressions for the nth term of linear and quadratic sequences
<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Convert between degrees and radians and apply this to trigonometric graphs and their transformations</li> <li>• Know exact values of angles measured in radians</li> <li>• Find an arc length using radians</li> <li>• Find the areas of sectors and segments using radians</li> <li>• Solve trigonometric equations in radians</li> <li>• Use approximation trigonometric values when <math>\theta</math> is small</li> </ul>	<b>Introduces:</b> <ul style="list-style-type: none"> <li>• Find the nth term of an arithmetic sequence</li> <li>• Prove and use the formula for the sum of the first n terms of an arithmetic series</li> <li>• Find the nth term of a geometric sequence</li> <li>• Prove and use the formula for the sum of a finite geometric series</li> <li>• Prove and use the formula for the sum to infinity of a convergent geometric series</li> <li>• Use sigma notation to describe series</li> <li>• Generating sequences using recurrence relations</li> <li>• Model real-life situations with sequences and series</li> </ul>

<b>Pure Chapter 4: Binomial Expansion</b>	<b>Pure Chapter 6: Trigonometric functions</b>
<b>Assessment:</b> Chapter 4 Binomial Expansion	<b>Assessment:</b> Ch 5 & 6 Straight line graphs and circles
<p><b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b></p> <ul style="list-style-type: none"> <li>• Algebraic fractions</li> <li>•</li> </ul> <p><b>Builds Upon (AS Mathematics - Pure Mathematics content):</b></p> <ul style="list-style-type: none"> <li>• Algebraic division, factor theorem</li> <li>• Binomial expansion of the form <math>(a+bx)^n</math>, where <math>n</math> is a positive integer</li> </ul>	<p><b>Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):</b></p> <ul style="list-style-type: none"> <li>• Sine and cosine function</li> <li>• Length of arc and area of sector</li> </ul> <p><b>Builds Upon (AS Mathematics - Pure Mathematics content):</b></p> <ul style="list-style-type: none"> <li>• Algebraic division, factor theorem</li> <li>• Solving trigonometric equations</li> <li>• <math>\sin 2x + \cos 2x = 1</math> and <math>\sin x \cos x = \tan x</math></li> <li>• Properties of graphs of <math>y = \sin x, y = \cos x</math> and <math>y = \tan x</math></li> </ul>
<p><b>Introduces:</b></p> <ul style="list-style-type: none"> <li>• Expand <math>(1+x)^n</math> for any rational constant <math>n</math> and determine the range of values of <math>x</math> for which the expansion is valid</li> <li>• Expand <math>(a+bx)^n</math> for any rational constant <math>n</math> and determine the range of values of <math>x</math> for which the expansion is valid</li> <li>• Use partial fractions to expand fractional expressions</li> </ul>	<p><b>Introduces:</b></p> <ul style="list-style-type: none"> <li>• Understand the definitions of secant, cosecant and cotangent and their relationship to cosine, sine and tangent</li> <li>• Understand the graphs of secant, cosecant and cotangent and their domain and range</li> <li>• Simplify expressions, prove simple identities and solve equations involving secant, cosecant and cotangent</li> <li>• Prove and use <math>\sec 2x = 1 + \tan^2 x</math> and <math>\operatorname{cosec} 2x = 1 + \cot^2 x</math></li> <li>• Understand and use inverse trigonometric functions and their domain and ranges</li> </ul>